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Spent Rod Safe™
by John P. Gnaedinger

There continues to be a national debate, and local reluctance to place spent rods, in the Yucca Mountain cavern design system. While there appear to be some very strong political pressures, not logic, as to the selection of this site as a national repository for spent rods, the local objections are even stronger.

1 The problems of putting all the spent rods in one site seems in itself to be counterproductive. After all, nuclear energy was developed in the first place by bringing the nuclear rods closer and closer together, under the Stagg Field bleachers at the University of Chicago.

The transportation of spent rods from all of the nuclear power plants in the country, some 60 total perhaps, involves substantial risk and cost.

There have been several shipments that overturned when their semi's were in accidents or otherwise had problems, exposing local people to some risk. The cost of the capsule is, to my knowledge, of the order of $1 million, involving the same 9" steel protection that is used for containment vessels at nuclear power plants themselves. It is also true that there are many alternatives being used for the design at these transportable capsules by different producers.

The Yucca Mountain site has two other issues involved with it. The first is that the Supreme Court has decided that the US Government must find a disposal site for spent rods, in terms of the 1982 legislation regarding nuclear power. The Federal Government has been frustrated in trying to find somebody willing to take the spent rods into their state, much less their community. They couldn't even reach agreement on a site to locate low level nuclear waste.

Thus, the Federal Government at the moment is faced with a decision as to what to do about their dilemma. The ideas proposed herein could represent a solution to that dilemma. It would cost the Federal Government perhaps of the order of 1% as much to pay for the cost for locating these spent rods in temporary storage at the site of the nuclear power plants themselves, rather than hauling them anywhere.

2 Another factor involving Yucca Mountain is that power companies have been paying one mil per kilowatt hour into a fund to complete the Yucca Mountain project. While it appears that these funds are perhaps being wasted, demonstrating the solution to the problem long before the site has been approved, which seems imprudent, there has also been a suggestion that actually the sums paid into the fund are of the order of $50 billion, and most of these funds might have been used for other government expenditures unrelated to the purpose of the funds, namely to handle spent rods.

3 There is another issue, perhaps more entrepreneurial than in political, that the power companies themselves should be the ones to accept responsibility for the disposal of the rods, particularly since they at least can dispose of them on their own property, as they are presently doing as a matter of necessity.

It seems to me that the Federal Government not only should support these techniques, but perhaps under the commitment of the 1982 Nuclear Act, should pay the cost. They certainly have enough money already on deposit in their Yucca Mountain fund to pay all these costs.

The ideas presently being used includes actually keeping the spent rods in above grade swimming pools at most of the nuclear power plants in the country. This technique does expose the spent rods and their storage facilities to a risk of Oklahoma City or World Trade Center terrorist practices and actions. It would therefore be much safer to have the spent rods buried, as is the proposal of the Spent Rod Safe™ concept.

A patent was obtained five years ago for storing the spent rods in ammunition bunker type structures, presumably at or in the vicinity of the nuclear power plant.

4 Outside storage on compacted granular pads, using stainless steel lined capsules, is being implemented by some firms, including Northern States Power.

Again, there is some exposure to vandalism or worse in terms of this outside storage.

Spent Rod Safe™ Concept

5... The inventor of this concept has been involved in the installation of the first deep caissons supporting major structures in this country. The installation of these caissons originally utilized equipment manufactured by Casey & Case in Los Angeles. Through the years, machine-drilled caissons supporting major structures in Chicago have replaced the traditional hand drug caissons, which have been used in Chicago for almost 100 years. The machine dug caissons have a great advantage cost-wise, and also safety-wise, both with regard to workers on the project, and with regard to the adjoining structures, providing proper precautions and steps are taken during installation of the caissons, of course.

The equipment is currently capable of drilling through soil or rock with diameters up to 11', and with depths up to 500'. The equipment for the rock drilling is similar to equipment used for tunneling, but operated vertically, in a mudded drill hole.

5 cont. The concept herein is that the rods be stored in capsules that are placed in 100 year temporary storage on the inside of perhaps a 7' diameter stainless steel casing at the center of the installation. The 7' steel casing would be surrounded with an 8' steel casing, with the annulus between the two filled with boron frit, recognized for its ability to absorb certain radiation.

The outside casing would be presumably 9' in diameter, regular steel, which is more resistant to deterioration due to soil chemicals than is stainless steel. The casings could further be protected by polyurea coatings, inside and out, of the order of 125 mil thickness.

In constructing the installation, there would of course be a drilling operation using mud, to drill to the desired depth of perhaps 500, or even 1000'.

Then the external casing would be progressively lowered in the mudded shaft, with a special rigging at the surface to prevent it from dropping, and with proper welding at the top of each casing when the next section is added.

Perhaps this could be accomplished more safely by having the casing welded together to perhaps 100' total length, before attaching to the casing already in the hole, to minimize the number of welds that would be made with a hanging arrangement for the casing being assembled.

It is proposed that in view of their top expertise in welding, such as with liquified natural gas tanks, that Chicago Bridge and Iron would the firm who would be involved in doing this welding.

After the welded assembly 500' long reaches the bottom of the shaft, then the bottom would be cleaned off with reverse rotary. An "airlift" system would work beautifully. Concrete would be tremie placed to perhaps a 50' depth at the bottom, as a plug in the bottom of the shaft. Perhaps a lesser depth would suffice.

Flotation would, of course, be a condition, to be avoided when the shaft is dewatered.

For many reasons, it might be preferable to construct a crane structure around the areas of proposed storage, before the shaft is drilled, with perhaps an arrangement for doing the drilling, installing the casings, and doing other work inside, to expedite the project and also to prevent vandalism for later purposes.

The slab of the proposed structure might be constructed of a 4-'6" thick concrete slab, with provision to anchor the external casing into this very heavy slab, to prevent flotation when the shaft is dewatered.

5 cont. Certainly different contractors would have different ways of handling the shaft drilling. It is proposed that Case Foundation Company, who has done much of the major caisson construction in the midwest, and elsewhere, in many cases, would be responsible for installing the shaft. They have given an estimate of $2.6 million as of September 1998, for installing two 500' deep shafts at a site, not counting steel costs or the installation of the casing.

It is expected that since the spent rods are changed every 18 months, and one capsule, perhaps 15' long would be required, at each change, that 100 years would require 1,000' of hole. Thus, the two 500' holes would suffice for each power plant, though the actual number, diameter and depth would depend on the number of units at a power plant and the other factors that would vary from site to site.

It is anticipated that Automated Engineering Company, Dr. Achyut Setlur, would be responsible for the design of the installation.

It is also assumed that STS Consultants, Ltd. would be responsible for the coordination with the contractor on the installation, and for inspection and instrumentation related to the installation.

It is, of course, expected that there would be substantial nuclear radiation instrumentation in the outer annulus, as well as ground water monitoring installation that would be read continuously, with equipment perhaps provided by Motorola, Inc.

Even if the building discussed is installed after completion of the shaft, to facilitate shaft performance, the building would still be beneficial after completion as a security measure, to essentially eliminate any access to the site or any opportunity for vandalism or other damage because of a security system and a surface plug at the top of the shaft that would not be easily removed.

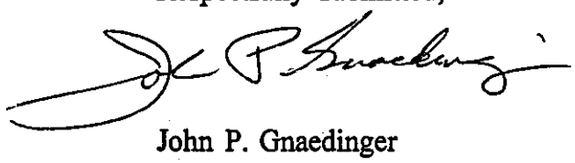
It would also be earthquake proof, providing of course, it is not installed in an actual fault. Even in an area that might have earthquakes, the shaft would move with any earthquake movement without damage.

The capsule would be retrievable, either by a one by one retrieval system, or perhaps by having stainless steel cables so installed that each unit could be lifted as required, for recovery of the spent rods materials to later facilitate production of nuclear power, or for other reuse.

5 cont. It is further proposed that all contracts on the project would include provision for Independent Project Peer Review, in accordance with ASCE Standards 22-97. Further, any disputes involved with construction would be resolved by mediation/arbitration, with a five person mediation arbitration board preselected by all parties in advance of construction. This would provide final and binding resolution of any disputes that are not resolved by negotiations and discussions, facilitated with good communication on the project.

Since the entire operation would take place at the nuclear power plant site itself, it would substantially reduce any risk to the neighborhoods, of nuclear problems from the spent rods. Because present storage is in swimming pools, it may not be necessary to get additional approval on installation. But it should be an easy matter to convince those to whom the approval would be presented, that this would represent a substantial increase in safety to the power plant, to the community, and to the country by eliminating the Yucca Mountain $250 Billion cost and related risks.

Respectfully submitted,



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